time.
Conclusions: SD for Δ was <1.5 mm in all directions, suggesting relatively good stability in the time-averaged position of these mobile targets. Delivery times were short and no correlation was observed between Δ and time. The results support frameless, free-breathing, lung SBRT performed with FFF RapidArc.

PD-0602
Tumor motion characterization and gating window assessment for stereotactic treatment of pancreatic cancer
H.D. Heerkens[1], C.A.T. van den Berg[1], S.P.M. Crijns[1], I.Q. Molenaar[2], F.P. Vleggaar[3], O. Reerink[1], M. van Zalk[1], H.N. Tijssen[1], M. van Vulpen[1], G.J. Meijer[1]
[1]UMC Utrecht, Radiotherapy, Utrecht, The Netherlands
[2]UMC Utrecht, Surgery, Utrecht, The Netherlands
[3]UMC Utrecht, Gastroenterology, Utrecht, The Netherlands

Purpose/Objective: Stereotactic irradiation of pancreatic cancers is hampered by respiratory movements of the tumor. An ITV that encloses the peak-to-peak breathing amplitude yields large PTVs and, therefore, may potentially harm nearby organs at risk. Gated delivery enables ITV reduction. However, this will increase treatment time as the radiation beam periodically is switched on and off. The aim of this work is to assess pancreatic tumor motion in order to find a patient specific optimal tradeoff between duty cycle and ITV.
Materials and Methods: 12 pancreatic cancer patients were imaged for a minute using cine-MRI on a 1.5T scanner. Sagittal and coronal scans, located through the center of the tumor, were acquired using a mixed T1/T2 weighted sequence (bSSFP) at a rate of two frames per second and a slice thickness of 7mm (fig 1A). Tumor tracking was performed with a Minimum Output Sum of Squared Error (MOSSE) adaptive correlation filter, which enables real-time tracking of a moving object.
Results: The greatest pancreatic tumor motion was found in cranio-caudal direction (mean 24mm, SD 13mm, range 10-49mm). The end-exhale position (EEP) was consistently reproduced (1SD=1.1mm, over all patients) whereas the end-inhale position (EIP) was less consistent (1SD=2.3mm, over all patients) (fig 1B). Further analysis also revealed that the tumors spend more time close to the EEP than to the EIP (average EIP/EEP ratio = 0.70, range 0.62-0.85). Both findings support the preference of gating around the EEP. At free breathing conditions, the entire breathing amplitude needs to be added to the 'static' CTV at EEP to build the ITV. However, this margin decreases dramatically - to a quarter of the amplitude (range 13%-40%) - when a gating duty cycle of 50% is used (beam on time = beam off time) (fig 1C).

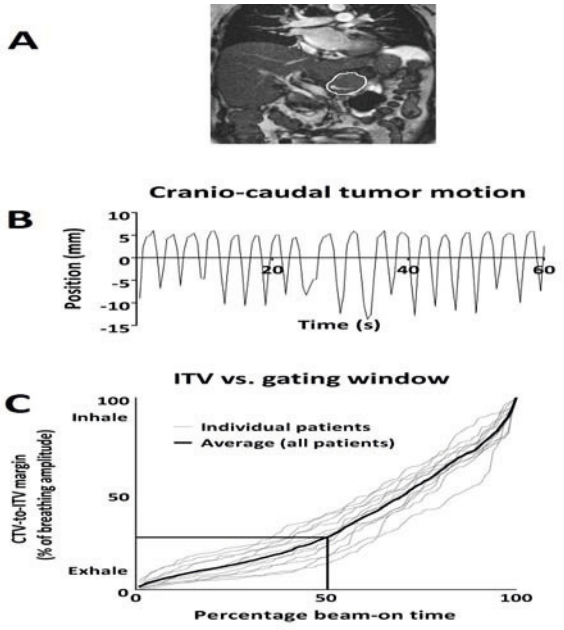

Figure 1A: Coronal cine-MRI image (bSSFP) in which tracking is performed in a patient with a tumor of the corpus of the pancreas (contoured). B: Example of cranio-caudal pancreatic tumor motion in time. C: Extent of ITV in relation to the gating window. As shown, at 50% beam-on time, the required CTV-to-ITV margin decreases to one quarter the breathing amplitude.

Conclusions: Gated delivery for stereotactic radiotherapy of pancreatic cancer is best performed around the end-exhale position. Considerable CTV-to-ITV margin reduction can be established at moderate gating windows, yielding acceptable treatment efficiency. A semi-automated method was developed to optimize gating window for individual patients.

PD-0603
Evaluation of 3 rotational techniques for cranial radiosurgery according to the target shape and their number.
J. Molinier[1], C. Kerr[1], N. Ailleres[1], S. Simeon[1], M. Charissoux[1], D. Azria[1], P. Fenoglietto[1]
[1]Centre Val d'Aurelle - Paul Lamarque, Radiation Oncology, Montpellier, France

Purpose/Objective: Cranial stereotactic radiosurgery treatment could today be delivering by different arctherapy techniques. In order to select the best one according to the number and the position of the lesions we compare in this study dynamic conformal arc, coplanar VMAT and noncoplanar VMAT.
Materials and Methods: Patients with single lesion (n=5), multiple lesions (n=5) and single lesion close to organs at risk (n=4) and previously treated with dynamic conformal arc (DCA) were selected for this analysis. For each patient, two additional plans were generated using 2 coplanar arc VMAT (RA_C) and noncoplanar arc VMAT (RA_{NC}). For single lesions, the ballistic for RA_{NC} is the same as for DCA (3-4 arcs per lesion). In multiple lesions case, only 4 noncoplanar arcs were used with a single isocenter compare with a multiple isocenter treatment for DCA. All plans were evaluated in regard to conformity and homogeneity indexes for PTV ($CI= (PTV_{\text{covered by prescription isodose}})^2/V_{PTV}*V_{\text{Presciption isodose}}$ and $I=(D_{max}-D_{min})/D_{mean}$), the healthy brain tissue dose (goal V_{10Gy} < 12,5cc) , the dose to organs at risk and the number of monitor units (MU).
Results: Concerning single lesion, the HI and the CI were better RA_{NC} but DCA improved healthy brain protection and treatment delivery time even if global room occupation is higher. For multiple lesions, VMAT techniques provided similar homogeneity and conformity degrees. The healthy brain was as well protected with DCA as with RA_{NC}. If we look the MU numbers, RA_C <RA_{NC} < DCA. For single lesion close to OAR, the HI was similar for VMAT techniques but RA_C improved the protection of healthy brain and organs at risk. On the other hand, the delivery treatment time is shorter with DCA even if overall time is lower with RA_C

	Single lesion				Multiple lesions				Single lesion close to OAR					
	HI	CI	Healthy brain V_{10Gy}(cc)	MU	HI	CI	Healthy brain V_{10Gy}(cc)	MU	HI	CI	Healthy brain V_{10Gy}(cc)	OAR D_{max}(Gy)	OAR D_{moy}(cc)	MU
DCA	0,27	0,76	11,97	3091,6	0,22	0,65	10,5	7308,2	0,57	0,54	2,31	14,15	3,66	2183,8
RA_C	0,23	0,83	18,34	4573,3	0,18	0,68	18,12	4841	0,31	0,65	1,56	12,59	3,20	3839,8
RA_{NC}	0,17	0,85	14,51	4639,1	0,17	0,67	10,5	4250,2	0,3	0,59	2	12,77	3,07	3532,5

Conclusions: For a single lesion, DCA provide better plan considering low doses to healthy brain even if quality indexes are better for the others techniques. For multiple lesions, RA_{NC} seems to be the best solution because it is able to deliver a good conformity and homogeneity plan while sparing healthy brain tissue. For a single lesion close to organs at risk, results are better with RA_C at the cost of an increase of MU but a lower treatment time compare with RA_{NC}.

POSTER DISCUSSION: 14: CLINICAL: GYNAECOLOGY/ GASTROINTESTINAL

PD-0604
Impact of bone marrow radiation dose on acute and late hematological toxicity in cervical cancer patients
O. Elicin[1], F. Herrera[1], S. Callaway[2], J. Prior[3], M. Ozsahin[1]
[1]Centre Hospitalier Universitaire Vaudois - CHUV, Department of Radiation Oncology, Lausanne, Switzerland
[2]Velocity Medical Solutions, Velocity Medical Solutions, Atlanta, USA
[3]Centre Hospitalier Universitaire Vaudois - CHUV, Department of Nuclear Medicine, Lausanne, Switzerland

Purpose/Objective: To investigate the impact of bone marrow (BM) radiation dose on standardized uptake value (SUV) changes of 18Fluorodeoxyglucose (FDG) Positron Emission Tomography (PET) taken pre and after chemo-radiotherapy in patients with cervical cancer, and to study the correlation between uptake values and acute/late hematological toxicity, respectively.